

Appl. No. 10/676,959
Amdt. Dated April 18, 2007
Reply to Office Action of January 18, 2007

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REMARKS/ARGUMENTS

Claims 1-10 are pending in the present application.

This Amendment is in response to the Office Action mailed January 18, 2007. In the Office Action, the Examiner objected claim 1, rejected claims 1-10 under 35 U.S.C. §112 and 35 U.S.C. §103(a). Applicants have amended claim 1. Reconsideration in light of the amendments and remarks made herein is respectfully requested.

Claim Objections

In the Office Action, the Examiner rejected claim 1 due to minor informalities. Applicants have amended claim 1. Accordingly, Applicants respectfully request the objection be withdrawn.

Rejection Under 35 U.S.C. § 112

In the Office Action, the Examiner rejected claims 1-10 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

The Examiner contends that the limitation "an approximately constant region" is indefinite, as there are no distinctions set forth in the specification regarding values of time and temperature, as well as the actual step of forming solder joints that this "approximately constant region" embodies (Office Action, page 2, paragraph number 3). Applicants respectfully disagree as argued in the previous response. However, to expedite the prosecution of the application, Applicants have amended claim 1 to remove the above limitation.

Therefore, Applicants respectfully request the rejection under 35 U.S.C. §112 be withdrawn.

Rejection Under 35 U.S.C. § 103

In the Office Action, the Examiner rejected claims 1-10 insofar as definite (in view of the 35 U.S.C. §112, 2nd paragraph rejections) under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,988,485 issued to Master et al. ("Master") in view of U.S. Patent No. 6,675,230 issued to Parhar ("Parhar"). Applicants respectfully traverse the rejection and

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submit that the Examiner has not met the burden of establishing a *prima facie* case of obviousness.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *MPEP §2143, p. 2100-129 (8th Ed., Rev. 2, May 2004)*. Applicants respectfully contend that there is no suggestion or motivation to combine their teachings, and thus no *prima facie* case of obviousness has been established.

Master discloses a flux cleaning for flip chip technology using environmentally friendly solvents. Fluxes commonly contain three constituents: a solvent, a vehicle, and an activator (Master, col. 4, lines 8-11). A reflow process consists of a preheat step where the solvent is vaporized (Master, col. 4, lines 12-14).

Parhar discloses water soluble fluxes and methods of using the same. The water soluble fluxes comprise at least one wax carrier (Parhar, col. 1, lines 34-46). The wax carrier may be any fatty carboxylic acid or derivative thereof (Parhar, col. 1, lines 57-58).

Master and Parhar, taken alone or in any combination, do not disclose, suggest, or render obvious, (1) the flux including at least a solvent and a water soluble monomer or a water soluble polymer, (2) the water soluble polymer having a melting point below 183°C if the solder bumps are eutectic or below 200°C if the solder bumps are lead-free; (3) the reflow temperature having a temperature profile including an increasing region, and a decreasing region, (4) the increasing region including temperature higher than the melting point of the polymer and forming polymer liquid, (5) the decreasing region solidifying the solder joints and the polymer liquid, and (6) the polymer liquid is solidified to re-distribute stress caused by thermal mismatch between the die and the substrate.

First, neither Master nor Parhar discloses or suggests a flux including at least a solvent and a water soluble monomer or a water soluble polymer. Master merely discloses “[f]luxes commonly contain three constituents: a solvent (e.g., alcohol), a vehicle (e.g., a high-boiling-point solvent such as aliphatic alcohol), and an activator (e.g., carboxylic acids).” (Master, col.

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4, lines 8-11). None of these corresponds to a water soluble monomer or a water soluble polymer. Parhar merely discloses preparing water soluble fluxes without disclosing how these fluxes are applied in a reflow process.

Second, neither Master nor Parhar discloses or suggests the water soluble polymer having a melting point below 183°C if the solder bumps are eutectic or below 200°C if the solder bumps are lead-free. Master merely discloses the solder bumps are heated to a temperature above the melting point of the solder (Master, col. 4, lines 28-20), without specifying the melting point of the polymers. Similarly, Parhar merely discloses the wax carrier having a melting point from about 55°C to 150°C, or other ranges (Parhar, col. 1, lines 54-57), not the melting point of the polymers as a function of the solder bumps. To clarify this aspect of the invention, claim 1 has been amended.

Third, neither Master nor Parhar discloses or suggests the reflow temperature having a temperature profile including an increasing region, and a decreasing region. Master merely discloses "[t]he reflow process (to be discussed) usually consists of a preheat step where the solvent is vaporized." (Master, col. 4, lines 12-14). Master does not describe how this preheat step is formed. There is no description of the temperature profile. The Examiner contends that the reflow temperature profile necessarily is a temperature/time profile that includes a heating (increasing) temperature, a maintenance (nearly constant) temperature (at least for a brief period of time – e.g., milliseconds), and a cooling (decreasing) temperature (Office Action, page 4, lines 4-12). Applicants respectfully disagree. Master does not describe the reflow temperature profile. The temperature profile could start from a high temperature, then decreases, and then increases, etc, or is just a constant temperature. Even if such a profile is contemplated, Master does not disclose or suggest how the regions of the profile affect the formation of the solder joints or the polymer in the flux.

Fourth, neither Master nor Parhar discloses or suggests the increasing region including temperature higher than melting point of the polymer and forming polymer liquid. Master merely discloses that the solder bumps are preheated to a temperature above the melting point of the solder (Master, col. 4, lines 28-31), not above the melting point of the polymer. To clarify this aspect of the invention, claim 1 has been amended. Furthermore, Master does not disclose or suggest a polymer liquid is formed during the increasing region. Master merely discloses that

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the flux residue areas are formed during the reflow processes and cleaning is required to remove these flux residue areas (Master, col. 4, lines 44-49), without specifying in what temperature region that a polymer liquid or the flux residue areas are formed.

Fifth, neither Master nor Parhar discloses or suggests the decreasing region solidifying the solder joints and the polymer liquid. Master merely discloses that when the solder melts, it forms a metallurgical bond with the bond pads 202 (Master, col. 4, lines 30-32). Melting a solder is the opposite of solidifying the solder. In addition, since Master does not disclose or suggest forming a polymer liquid, Master cannot possibly disclose or suggest solidifying the polymer liquid.

Sixth, neither Master nor Parhar discloses or suggests the polymer liquid is solidified to re-distribute stress caused by thermal mismatch between the die and the substrate. Master merely discloses a cleaning agent and a method of flux cleaning that is environmental friendly (Master, col. 4, lines 30-32). Cleaning is a process to remove the flux residue areas because the excessive residue may be harmful to chips (Master, col. 4, lines 46-49). not to re-distribute the stress caused by thermal mismatch.

Parhar merely discloses a wax carrier to be used in a water soluble flux. Parhar discloses that the water soluble fluxes are in the form of a paste (Parhar, col. 4, lines 36-37). Parhar's teaching aims at avoiding turning water soluble flux into liquid above 100°F (Parhar, col. 1, lines 24-31). Therefore, Parhar effectively teaches away from the invention.

In the Office Action, the Examiner contends that Parhar does not teach away from the invention, because column 1, lines 24-31 of Parhar addresses "background art" temperature, not the inventive temperatures of Parhar (Final Office Action, page 7, lines 6-10). Applicants respectfully disagree. The background art section discusses the motivation of Parhar's teaching, which is an important factor in combining references under the 35 U.S.C. §103(a) rejection. Parhar's teaching avoids turning into liquid above 100°F. Therefore, Parhar clearly teaches away from forming a polymer liquid, as recited in claim 1.

Furthermore, there is no motivation to combine Master and Parhar because neither of them addresses the problem of re-distribution of stress caused by thermal mismatch between the die and the substrate. There is no teaching or suggestion that a temperature profile having three regions is present. Master, read as a whole, does not suggest the desirability of forming polymer

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liquid and solidifying the solder joints and the polymer liquid. In addition, it is improper to combine references where the references teach away from their combination. In re Grasselli, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983). Since Parhar teaches away from the combination, combining Master and Parhar is improper. For the above reasons, the rejection under 35 U.S.C. §103(a) is improperly made.

The Examiner failed to establish a prima facie case of obviousness and the motivation to combine the references. When applying 35 U.S.C. 103, the following tenets of patent law must be adhered to: (A) The claimed invention must be considered as a whole; (B) The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination; (C) The references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and (D) Reasonable expectation of success is the standard with which obviousness is determined. Hodosh v. Block Drug Col. Inc., 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986). "When determining the patentability of a claimed invention which combined two known elements, 'the question is whether there is something in the prior art as a whole suggest the desirability, and thus the obviousness, of making the combination.'" In re Beattie, Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 730 F.2d 1452, 1462, 221 USPQ (BNA) 481, 488 (Fed. Cir. 1984). To defeat patentability based on obviousness, the suggestion to make the new product having the claimed characteristics must come from the prior art, not from the hindsight knowledge of the invention. Interconnect Planning Corp. v. Feil, 744 F.2d 1132, 1143, 227 USPQ (BNA) 543, 551 (Fed. Cir. 1985). To prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the Examiner to show a motivation to combine the references that create the case of obviousness. In other words, the Examiner must show reasons that a skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the prior elements from the cited prior references for combination in the manner claimed. In re Rouffet, 149 F.3d 1350 (Fed. Cir. 1996), 47 USPQ 2d (BNA) 1453. "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or implicitly suggest the claimed invention or the Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of

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the references." Ex parte Clapp, 227 USPQ 972, 973. (Bd.Pat.App.&Inter. 1985). The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. In re Mills, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Furthermore, although a prior art device "may be capable of being modified to run the way the apparatus is claimed, there must be a suggestion or motivation in the reference to do so." In re Mills 916 F.2d at 682, 16 USPQ2d at 1432; In re Fitch, 972 F.2d 1260, 23 USPQ2d 1780 (Fed. Cir. 1992).

In the present invention, the cited references do not expressly or implicitly suggest, among other things, the water soluble polymer having a melting point below 183°C if the solder bumps are eutectic or below 200°C if the solder bumps are lead-free, and a temperature profile having at least two regions. In addition, the Examiner failed to present a convincing line of reasoning as to why a combination of Master and Parhar is an obvious application of solidifying the polymer liquid to re-distribute stress caused by thermal mismatch between the die and the substrate.

Therefore, Applicants believe that independent claim 1 and its respective dependent claims are distinguishable over the cited prior art references. Accordingly, Applicants respectfully request the rejection under 35 U.S.C. §103(a) be withdrawn.

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Conclusion

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: April 18, 2007

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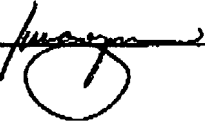
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